

QUILT GEOMETRY

Suggested Grade

6

SD Mathematics Strand & Standard (*Primary for Task*)

Geometry

6.G.2.1. Students are able to use basic shapes to demonstrate geometric concepts.

Task Summary

Students identify geometric concepts in sample quilt designs and then design quilt blocks to demonstrate their understanding of translation, reflection, and rotation.

Time and Context of Task

This task can be done at any time during a geometry unit after the concepts of translation, rotation, and reflection have been introduced. It takes one class period for students to complete the first two parts of the task. The amount of time needed for the third part depends on how complicated a block the student designs. I gave them a week to design, color and put together their blocks. We then spent a second class period for students to share their reports and quilt designs.

Materials Needed

Directions Worksheet, Quilts of Varying Patterns, Quilt Books

Author and Lead Teacher for This Task

Becky Umenthum

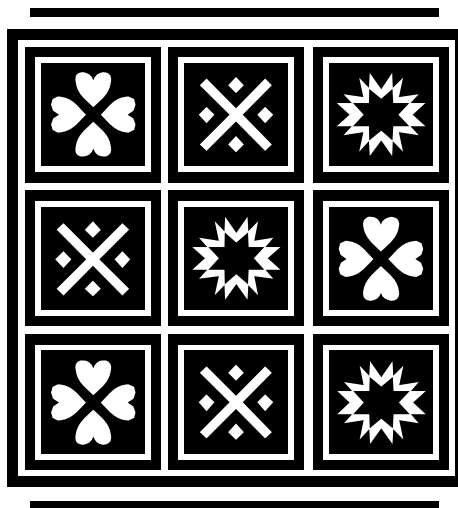
Belle Fourche Middle School

QUILT GEOMETRY

(1) In groups of 2, 3, or 4 students, pick a quilt or a quilt book and look for examples of geometric concepts. Find and record as many examples as you can using the words in the list below. Be prepared to share your examples with the rest of the class.

(2) Quilters often use the geometric concepts of translation (slide), reflection (flip), and rotation (turn) in their quilts. Sometimes you see these concepts within the quilt blocks and sometimes they are used in arranging the blocks to make the quilt. Look again at your quilt or in your quilt book to see how translations, reflections, and/or rotations were used.

(3) Now it your turn to design a quilt. Use the square paper to design a quilt block. Start by dividing your square into either a 2 x 2, 3 x 3, or 4 x 4 grid of equal size squares. Now you can divide or combine squares to make rectangles, triangles, or other shapes. As you design your block, you must use at least one translation, reflection, or rotation. When you're satisfied with your block, bring it to your teacher for her to make copies of your block. If you want to end up with a square quilt, make 16 or 25 copies. If you want a rectangular quilt, make 20 or 24 copies. Color the quilt blocks the same and then cut them out. Experiment with different arrangements of your blocks, again using the concepts of translation, reflection, and rotation. (Hint: If you want to use reflections, you may need to hold the block up to a window. Trace on the back side of the paper and color it there to get the mirror image.) When you're satisfied with the arrangement, tape them together to make your quilt. When you share your quilt with the class, be ready to identify the translations, reflections, and/or rotations.





Quilt Geometry

Finding Geometric Shapes and Concepts

Step 1: Pick a quilt or a quilt book and look for examples of geometric concepts and shapes. Find and record as many examples as you can using the words in the list below. Be prepared to share your examples with the rest of the class.

line segment	symmetry	quadrilateral	acute angle
ray	parallel lines	rhombus	right angle
polygon	perpendicular lines	square	obtuse angle
angle	equilateral triangle	rectangle	pentagon
vertex	isosceles triangle	trapezoid	hexagon
triangle	scalene triangle	parallelogram	octagon

Step 2: Quilters often use the geometric concepts of translation (slide), reflection (flip), and rotation (turn) in their quilts. Sometimes you see these concepts within the quilt blocks and sometimes they are used in arranging the blocks to make the quilt. Look again at your quilt or in your quilt book to see how translations, reflections, and/or rotations were used.

Step 3: Now it your turn to design a quilt. Use the square paper to design a quilt block. Start by dividing your square into either a 2 x 2, 3 x 3, or 4 x 4 grid of equal size squares. Now you can divide or combine squares to make rectangles, triangles, or other shapes. As you design your block, you must use at least one translation, reflection, or rotation. When you're satisfied with your block, bring it to your teacher for her to make copies of your block. If you want to end up with a square quilt, make 16 copies. If you want a rectangular quilt, make 20 or 24 copies. Color the quilt blocks the same and then cut them out. Experiment with different arrangements of your blocks, again using the concepts of translation, reflection, and rotation. (Hint: If you want to use reflections, you may need to trace the block on the back side of the paper and color it there to get the mirror image.) When you're satisfied with the arrangement, tape them together to make your quilt. When you share your quilt with the class, be ready to identify the translations, reflections, and/or rotations.



CONTENT STANDARDS

Primary Standard

Strand Name: Geometry

SD Goal: Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator: Use properties of geometric figures to solve problems from a variety of perspectives.

Standard: 6.G.2.1. Students are able to use basic shapes to demonstrate geometric concepts.

NCTM Process Standard

Communications: Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Problem-Solving Strategies

- Looking for patterns
- Find examples of geometric concepts in real-world objects.

ASSESSMENT TOOLS

Task Rubric

	Advanced	Proficient	Basic	Below Basic
Content Standard: 6.G.2.1. Students are able to use basic shapes to demonstrate geometric concepts.	Identifies most of the geometric concepts in the sample quilts. Identifies the concepts of rotation, reflection, and translation and uses them in their quilt design.	Identifies many of the geometric concepts in the sample quilts. Identifies the concepts of rotation, reflection, and translation.	Identifies some of the geometric concepts in the sample quilts. With help, is able to identify the concepts of rotation, reflection, and translation.	Has trouble identifying geometric concepts in the sample quilts. Is unclear about the concepts of rotation, reflection, and translation.
NCTM Process Standard: Communication: Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.	Clearly and consistently uses language that is mathematically correct.	Uses clear language that frequently includes appropriate mathematical terminology.	Uses language that sometimes is mathematically correct.	Uses vague language that does not use mathematical terminology.

Sixth Grade Geometry Performance Descriptors

Advanced	Sixth grade students performing at the advanced level: <ul style="list-style-type: none"> develop and apply a variety of strategies and properties to analyze two-dimensional geometric figures.
Proficient	Sixth grade students performing at the proficient level: <ul style="list-style-type: none"> use geometric concepts to identify and describe characteristics of lines, angles, triangles, and quadrilaterals.
Basic	Sixth grade students performing at the basic level: <ul style="list-style-type: none"> identify characteristics of lines, angles, triangles, and quadrilaterals.

Sixth Grade Geometry ELL Performance Descriptors

Proficient	Sixth grade ELL students performing at the proficient level: <ul style="list-style-type: none"> use geometric concepts to identify and describe characteristics of angles, triangles, and quadrilaterals; read, write, and speak the basic language of geometry.
Intermediate	Sixth grade ELL students performing at the intermediate level: <ul style="list-style-type: none"> identify and verbally describe angles, triangles, and quadrilaterals; write responses with oral support; explain in geometric terms the sequence of steps used in solving problems; give simple oral responses to directed questions on topics presented in class.
Basic	Sixth grade ELL students performing at the basic level: <ul style="list-style-type: none"> identify angles, triangles, squares, rectangles, and parallelograms; give limited written responses, which may include simple sentences, to directed questions on topics presented in class; recognize and use basic geometric terms; respond to yes or no questions and to problems presented pictorially or numerically in class.
Emergent	Sixth grade ELL students performing at the emergent level: <ul style="list-style-type: none"> produce correct mathematical symbols and words in written and oral formats; recognize symbolically and pictorially represented mathematical concepts; copy and write geometric shapes and symbols; imitate pronunciation of geometric terms; use non-verbal communication to express mathematical ideas such as recognizing simple geometric figures.
Pre-emergent	Sixth grade ELL students performing at the pre-emergent level: <ul style="list-style-type: none"> observe and model appropriate cultural and learning behaviors from peers and adults; listen to and observe comprehensible instruction and communicate understanding non-verbally.

QUILT GEOMETRY

Student Work Samples



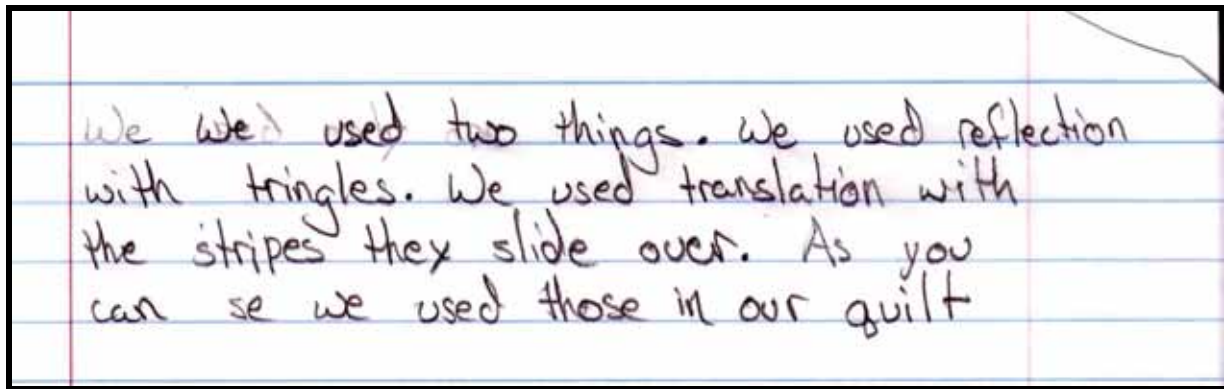
As you examine the samples, consider the following questions:

- In light of the standard/s addressed and the assessment tools provided, what evidence does the work provide that students are achieving proficiency in the knowledge and skills addressed by the standard/s for the task?
- Is the task/activity well designed to help students acquire knowledge and demonstrate proficiency? Is the task/activity clearly aligned with the standards? In what ways would you adapt the task/activity to better meet the needs of your students?

Student Group #1 Work Sample



Sample #1 – page 2

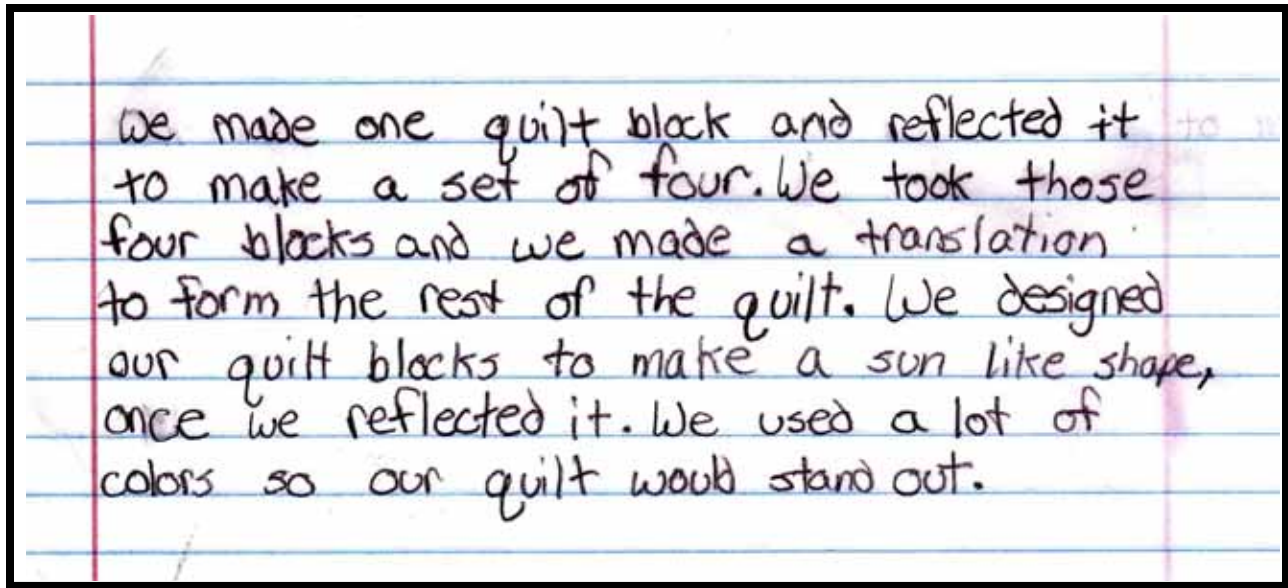


Looking at Student Work – Instructor notes and rating for work sample #1:

Student Group 1 – They correctly identified the use of reflection with the triangles in their blocks. However, they incorrectly identified the stripes as being translated. Actually all the blocks are reflections of each other. This is easy to see because there are no lines of symmetry within the blocks. When asked about this during their verbal presentation, the group said that they had only looked at the size of the lines, not their orientation. One they started looked at the angles forms where the lines met, they realized that they were reflections. Since they had been able to identify most of the geometric concepts listed in Step 1 in their first verbal presentation, this group received a score of “Proficient” on Content Standard 6.G.2.1 and a score of “Basic” on NCTM Process Standard, Communication.

Student Group #2 Work Sample:





Looking at Student Work – Instructor notes and rating for work sample #2:

This group planned to put their blocks together to make a sun. They laid the blocks out before they colored them and realized that they would have to color on the back side of half of the blocks if their design was to work. In both their written paragraph and oral presentation, they correctly identified the use of reflections within each set of four blocks, and translations between these sets. This group also identified most of the geometric concepts in Step 1, so they received a score of “Advanced” on Content Standard 6.G.2.1 and a score of “Proficient” on NCTM Process Standard, Communication.

Student Group #3 Work Sample:



Sample #3 – page 2

I planned my quilt block design so I could rotate the blocks so each set of four blocks looked like a spider. The first time I did this, my curved lines did not match. I asked my teacher and she told me that if I wanted the lines to match I had to have them the same distance from the corner. I tried that and it worked. So my quilt has rotational symmetry with each set of four blocks. I then translated the set of four blocks so I have four spiders on my quilt.

Looking at Student Work – Instructor notes and rating for work sample #3:

This student is on an IEP, so he dictated his paragraph to the resource room aide. He has a vision problem but really wanted to do the activity, so he needed help with his design and coloring. He was able to identify some of the geometric concepts in Step 1, but needed help in incorporating the concept of rotational symmetry into his quilt. He also needed help in identifying how the first spider was translated to form the other spiders. Because of the extra help that he was given, he received a score of “Basic” on the Content Standard 6.G.2.1 and the NCTM Process Standard, Communication.

Student Group #4 Work Sample:



Sample #4 – page 2:

The quilt blocks we colored had symmetry - I saw that after drawing the patterns. I thought it'd be better to color it so it didn't emphasize the four lines of symmetry. After coloring them all, my classmates and I put it together ~~so~~ so that a block colored the same was translated two up or two places to the side. We had two ways of coloring the blocks giving a cool effect. There ~~isn't~~ any reflected symmetry because of that. ~~But~~ ^{Although} it looks like there is where colors on the edges meet. But if you look at the center four blocks of each block, you see that it isn't ~~the~~ reflecting symmetry. If you look closely the blocks have rotational symmetry too.

Looking at Student Work – Instructor notes and rating for work sample #4:

This group was able to identify almost all of the geometric concepts in both Steps 1 and 2. When designing their own quilt block, they recognized the lines of symmetry within their block and decided to color it so there was no symmetry. They correctly identified the translations first and then noticed the rotational symmetry. When asked by classmates about reflections, they explained why it looked like a reflection but really wasn't. They received a score of "Advanced" on both Content Standard 6.G.2.1 and NCTM Process Standard, Communication.

Instructional Notes

I planned to have most of the mathematical communication be verbal on this activity. It is much easier to hold up a quilt and point to different geometric concepts, than it would be to try to identify the concepts in narrative form. Since I needed work samples, I had the students write a paragraph telling how they used the concepts of translation, reflection, and/or rotation in putting their quilt blocks together in a quilt. They also did verbal presentations, which were more detailed and a better way to demonstrate understanding of these concepts. I wish now that I had recorded their presentations instead of asking them for a written explanation.

One extension that I do is to have a Quilt Block Design Contest. Students can design one or more quilt blocks for a 6th grade quilt. They then vote on their favorite designs and I sew the 14 winning blocks, plus a center panel that all students sign, into a wallhanging. The wallhanging decorates their class's area of the middle school. Other extensions would be to find examples of translations, reflections, and rotations in floor tile or wallpaper patterns.

For the first two steps, students checked words on the list as they found them. Those that made a short note about where they found them did better presentations than those who didn't. The students, who had the easiest time putting their quilt blocks together, planned what the whole quilt would look like as they designed their block.

Many students made symmetrical quilt blocks, which they colored in a way that kept those lines of symmetry. That made it difficult to identify whether they used translations, rotations, or reflections in putting the blocks together, as they all looked the same. For example, in the verbal presentations, students might say they used rotation and their classmates might argue that it just looked like a translation.

Resources

SD Mathematics Content Standards

<http://www.doe.sd.gov/contentstandards/math/index.asp>

SD Assessment and Testing

<http://www.doe.sd.gov/octa/assessment/index.asp>

The National Assessment of Educational Progress (NAEP)

<http://www.doe.sd.gov/octa/assessment/naep/index.asp>

National Council of Teachers of Mathematics

<http://nctm.org/>

Looking at Student Work

<http://www.lasw.org/index.html>